WHAT IS CLAIMED IS:

1. A process for oxidizing a feed component with an oxidizing agent comprising oxygen, the process comprising dissolving the feed component and the oxidizing agent in a reaction solvent selected from the group consisting of fluorocarbons, chlorofluorocarbons, hydrochlorofluorocarbons, fluorine-substituted oxygenated hydrocarbons, and mixtures thereof, and thereafter reacting the feed component and the oxidizing agent in the presence of a solid oxidation catalyst and under effective oxidation conditions to yield an oxidized product that is preferentially soluble in a product solvent compared to the reaction solvent.

2. The process of claim 1 where the reaction solvent, the solid oxidation catalyst, and the product solvent are contained in an oxidation reactor, and the reaction solvent and product solvent are present as separate liquid phases.

3. The process of claim 2 further comprising maintaining a gaseous environment above the reaction solvent and product solvent, where the gaseous environment has a total concentration of the oxidizing agent and the feed component of less than about 1% by volume.

4. The process of claim 1 where the feed component comprises hydrogen or a hydrocarbon selected from the group consisting of ethylene, propane, propylene, n-butane, isobutane, isobutylene, tertiary butyl alcohol, orthoxylene, metaxylene, paraxylene, and mixtures thereof.

5. The process of claim 1 where the oxidizing agent is air.

6. The process of claim 1 where the reaction solvent has an oxygen solubility of greater than about 50 ml per 100 ml of reaction solvent and a water solubility of less than about 50 ppm by weight at 1 atmosphere and 25°C.

7. The process of claim 6 where the reaction solvent is a fluorocarbon selected from the group consisting of perfluoropentane, perfluorohexane, perfluororheptane, perfluorooctane, and mixtures thereof.

8. The process of claim 1 where the product solvent comprises water or an aqueous solution.

9. The process of claim 1 where the solid oxidation catalyst comprises a solid support having dispersed thereon a metal selected from the group consisting of Au, Ag, Pt, Pd, Ir, Rh, Hg, Ru, Os, and mixtures thereof.

10. The process of claim 9 where the support is selected from the group consisting of inorganic refractory metal oxides, carbon, and polymers.

11. The process of claim 1 where the feed component comprises hydrogen, the oxidized product comprises hydrogen peroxide, and effective oxidation conditions include a temperature from about 0°C to about 90°C, an absolute pressure from about 1 to about 200 atmospheres, a gas hourly space velocity from about 50 to about 50,000 hr^{-1}, and mechanical agitation.

12. The process of claim 11 where the oxidation catalyst comprises palladium dispersed on a support comprising carbon or alumina.

13. The process of claim 11 where the product solvent is an aqueous solution comprising an inorganic acid selected from the group consisting of nitric acid, hydrochloric acid, phosphoric acid, sulfuric acid, and mixtures thereof, where the product solvent has a pH from about 0 to about 5.

14. The process of claim 11 where hydrogen and oxygen are reacted in a molar ratio of hydrogen to oxygen from about 0.05 to about 15.

15. The process of claim 11 further comprising, after oxidation, reacting the hydrogen peroxide with an olefinic product stream selected from the group consisting of a paraffin dehydrogenation process effluent, a methanol-to-olefins process effluent, a thermal cracking process effluent, and mixtures thereof to yield a C_2-C_5 oxide product.

16. The process of claim 15 where the feed component is selected from the group consisting of a paraffin dehydrogenation hydrogen effluent stream, a thermal cracking process hydrogen effluent stream, and mixtures thereof.

17. The process of claim 11 further comprising, after oxidation, reacting the hydrogen peroxide with an intermediate component selected from the group consisting of aromatics, olefins, ketones, carbonyls, and mixtures thereof to yield a downstream product selected from the group consisting of oxidized aromatics, epoxides, lactones, oximes, and mixtures thereof.

18. The process of claim 17 where the intermediate component is cyclohexanone, the downstream product is cyclohexanone-oxime, and the cyclohexanone-oxime is further reacted to yield caprolactam.

19. A process for producing an oxidized product, the process comprising:

a) dissolving a feed component and an oxidizing agent in a reaction solvent selected from the group consisting of fluorocarbons, chlorofluorocarbons, hydrochlorofluorocarbons, and mixtures thereof;

b) reacting the feed component and the oxidizing agent in a reaction zone under effective oxidation conditions and in the presence of a solid oxidation catalyst to yield an oxidation product;

c) extracting the oxidation product into a product solvent in which the oxidation product is preferentially soluble;

d) separating the oxidation product and residual amounts of the reaction solvent in the product solvent from the product solvent to yield a regenerated product solvent, a purified oxidation product, and a recovered reaction solvent; and,

e) recycling the recovered reaction solvent to the reaction zone.

20. The process of claim 19 where the feed component comprises hydrogen, the oxidizing agent comprises oxygen, the oxidized product comprises hydrogen

peroxide, and effective oxidation conditions include a temperature from about 0°C to about 90°C, an absolute pressure from about 1 to about 200 atmospheres, a gas hourly space velocity from about 50 to about 50,000 hr^{-1}, and mechanical agitation.

21. The process of claim 19 where step (d) includes distilling or decanting the product solvent containing the reaction product and residual amounts of reaction solvent.

22. The process of claim 19 where steps (a) – (c) occur within the reaction zone containing the reaction solvent and product solvent as separate liquid phases.

23. The process of claim 22 further comprising maintaining a purge gas stream through a gaseous environment above the reaction zone to remove gaseous contaminants entering the reaction zone with the feed component and the oxidizing agent.

24. The process of claim 23 where the gaseous environment has a total concentration of the oxidizing agent and the feed component of less than about 1% by volume.

25. The process of claim 23 where the purge gas stream comprises a noble gas or an inert gas selected from the group consisting of nitrogen, carbon dioxide, and mixtures thereof.